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**THE EVOLUTION OF REVOLUTION: APPLICATION OF
INFORMATION TECHNOLOGY IN MILITARY LOGISTICS**

BY

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ABSTRACT

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Force sustainment has evolved over the decades from collecting spoils to foraging to individual sustainment and finally to one of centralized support. Over time, the introduction of new technologies like storage containers for food preservation, the wheel for transporting supplies, the gasoline engine for transport power, and the airplane with jet engines have contributed dramatically to revolutionizing logistical support to armies throughout the world. We have shortened the resupply time through various process improvements. Through FORCE XXI we are applying information technology to further decrease our response time for critically needed support by providing a greater battlespace awareness to the combat commander on the ground. We have brought supplies closer to the user through a faster and more responsive acquisition and "just in time" supply distribution system. Is this enough or can we do better? This study argues the terribly important need for yet another technological breakthrough to achieve a real revolution in military logistics.

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“An education is not how much you have committed to memory or even how much you know. It is being able to differentiate between what you know and what you do not. It is knowing where to go find out what you need to know. And it is knowing how to use the information once you get it.”

William Feather

Many claim that the introduction and use of information technology has created a revolution in military affairs (RMA). But we shall not see a true revolution until there is either a profound application of an old technology or introduction of a new technology. This is also true for military logistics. For decades logisticians have continued to support the design of weapon systems instead of designing the support. Seldom, if ever, does the Army award contracts on the basis of projected life cycle costs of the system. We procure on the basis of near-term costs, schedule, and proven or projected system effectiveness. Even when life cycle costs are considered early in the acquisition process, they tend to be sacrificed when financial tradeoffs must be made.

This paper reflects a study of our strategic military logistics system to ascertain whether we truly have a revolution in military logistics or if we are merely undergoing a continuum of evolution. It argues the need for the dramatic application of some yet untapped technology in order to experience a genuine revolution in military logistics.

So where does one start to truly revolutionize logistics support for U.S. forces in a joint combined multinational force? The regional Commanders in Chief (CINCs) are the logical starting point. The Joint Operation Planning and Execution System (JOPES) is the overarching tool.¹

THE CINCS ROLE

CINCs must plan and form regional coalitions today to be successful on the battlefield of tomorrow. Desert Shield and Desert Storm were conducted by one of the most diverse coalitions of military forces in history. Although a huge success in many respects, this complex operation was far from flawless. Tomorrow's Army cannot afford to operate at

less than an optimum level. We must strive to achieve a maximum efficiency in all operational and functional areas; logistics especially deserves our wholehearted attention. Systematic improvements to our logistics support concepts must begin at the highest levels of leadership.

Operation Desert Shield began with inadequate logistical command and control (C2) due to priorities to combat forces and limited reserve component call up. The Army utilized an ad hoc logistics C2 headed by the assistant deputy chief of staff for logistics (DCSLOG), a general officer.² We used the Return of Forces to Germany (REFORGER) model to establish logistics support in the desert. There was a tremendous reliance on host nation support and local contracting to meet many supply and transportation needs.³ As port facilities became increasingly backlogged, incoming supplies were not easily tracked with 10,700 requisitions being processed daily. Services unknowingly competed with one another for contract supplies and services. Suffice to say that many lessons learned came out of the desert. The issues are not small and the fix must come from a cooperative effort and top leadership.

Our National Security Strategy specifies where we expect to deploy and/or fight (Korea, Iran, or Iraq); it requires us to consider the global arena.⁴ Our planning and training priorities must focus on those volatile locations with the highest likelihood for deployment and/or application of our military forces. With some scrutiny, a CINC can as well develop anticipated scenarios in terms of actors. Plausible actors may be predicted through reviewing regional and nonregional friendly, neutral, and threat countries. Non-regional neutrals will most likely be inconsequential, but they should not be entirely overlooked.

Nation states within the region will nearly always influence the coalition structure by falling into one of the three categories indicated. U.S. strategists must consider potential member or actors from all corners of the globe. Countries will most certainly fall into one of the three categories; they may gravitate from one category to another. They may change in positions for any number of reasons. Their respective national interests and their diplomatic relationships will influence their choice of positions. Therefore CINCs should proactively foster a good relationship at the military level to support our national and political interests on a country-by-country basis throughout their assigned region. Such important relationships can pay tremendous dividends in the long run.

We cannot discount the nonregional players. Today's "infotech" world grows smaller and more globally interdependent. Nation states at opposite ends of the globe may be more compelled to get involved in a regional conflict than will a neighboring state. As in the case of Japan during Desert Shield/Storm, non-regional players can share a commensurate portion of the resources burden. The financial burden in Bosnia is fast becoming a controversial issue.

Every nation state becomes an actor or remains neutral during any regional conflict, even in peace-making or humanitarian efforts. Thus CINCs should maintain an itemized list of capabilities for each nation state within their domain. These should include resources which may be committed to the mission. Resources may be soldiers, money, transportation, industrial capabilities, equipment, arms, ammunition, or supplies. Other agencies can help CINCs with gathering such data. Once an automated database is established, updates must be accomplished in order to achieve an optimal currency and use-

fulness. Annual updates at a minimum are necessary. CINCs should have decentralized access to a central database which would provide such information.

Automated simulations could project integrating the actors and their respective resources in given scenarios. The simulation would develop a timeline showing the resources to be provided, where they come from, and how they got to theater. For example, the hypothetical government of Trebe may offer up 100,000 rounds of 120mm tank main gun bullets. But if Trebe has no transportation capabilities to move the munitions, they may never arrive! So the requisite transportation must be identified and provided. The CINC, who establishes requirements and priorities, may shuffle those priorities based on the source and mode of transport. This may sound simple. But try developing a composite timeline and synchronizing all the elements for a given scenario.

Logistic support for coalition forces has historically been a national responsibility of each nation in the combined force. With the right planning, a single source provider could serve the entire coalition. But such a logistical plan would be more revolutionary than any current contingencies. True, we face the challenges of equipment diversity, variations in ammunition and even varying dietary preferences. A CINC has the opportunity to influence some of this through Security Assistance priorities. The sale or transfer of specific weapon systems could achieve some semblance of standardization. Interoperability would be the second choice when coalition planning.

Some CINCs already have a framework in place to begin this coalition forming process without starting at the bottom. The CINC Europe (CINCEUR) is a case in point. Given increasing deployment of multinational forces, North Atlantic Treaty Organization

(NATO) logisticians updated policies in 1992. The NATO Defense Planning Committee did that in 1992 when they published Military Committee (MC) Decision 319.

This decision established three new working propositions:

- +NATO authorities have collective responsibility for logistics support of NATO's multinational operations
- +NATO commanders must be given sufficient authority over logistics resources.
- +NATO commanders have increased authorities and responsibilities in the area of host nation support⁵

Responding to these propositions, the Central Region's Chiefs of Army Staff (CR-CAST) agreed on the formation of a multinational deployment agency (MDA). This MDA would manage the strategic movement of NATO forces leaving the Central Region. Once in theater, a multinational Theater Movement Control Center would manage the forward movement effort. Planners agreed to form a multinational logistics staff in the G4 office of the combined land component command and to establish a combined support command.⁶

These principles pass the common sense test with flying colors. The next step was to test the process. Atlantic Resolve '94, which replaced REFORGER, was the vehicle. The purpose of the test was to validate the requirement for the MDA, the multinational logistics staff, and the combined support command. The test was successful.⁷

Movement of multinational forces was complicated by varying deployment time schedules for each country. The MDA successfully simplified the schedules and moved troops to the area of operations. The Joint Multinational Logistics Command (JMLC) utilized the Theater Movement Control Center (TMCC) to manage the flow of incoming

resources at the port of entry. This TMCC was both joint and combined, which facilitated coordination.⁸

The Combined Support Command (CSC) under the Combined Land Component Command managed in-country transportation services, materiel distribution, and mortuary affairs. The Combined Logistics Center of the CSC was also staffed with multinational and joint personnel making coordination easier. Shifting priorities were dealt with successfully, even during ongoing enemy action.⁹

These new NATO logistics policies have demonstratively succeeded. The Atlantic Resolve '94 demonstrates the desirability of multinational logistics support for peacekeeping operations. Organizing and structuring our logistics support staff with increased multinational representation makes sense. Once this structure is in place, we need to establish procedures for dealing with repair parts, services, and funding for both. A test must be conducted to ferret out the problems and address them one by one.

Clearly, future U.S. forces will serve as members of a coalition in future operations. Why wait until the need arises to plan this coalition? If we continue with such an ad hoc approach, we will find ourselves in the midst of one crisis management effort after another. To avoid such a haphazard approach, we should envision a computer simulation that will collate the input and generate a potentially winning coalition for any number of scenarios. We can work up simulations based on single-page matrices or based on robust flights of true imagination. The possibilities are almost endless. But the practicality is that we should plan now, forecast now in order to respond smarter, quicker, and cheaper to future contingencies.

Sound expensive? Nothing good is without cost. Perhaps friendly potential actors would be willing to share the cost burden for development of a simulation. The fiscally logical justification for investing now is to avoid paying much more later. If we can fairly accurately anticipate the next "Storm," then we can better channel our national resources and military power into the operation. Coalition planning is tentative and somewhat risky, but economic interdependency is a reality of transnational interests.

Members of the United Nations may be persuaded of their mutual interest in this concept. North Atlantic Treaty Organization (NATO) signatories should certainly perceive a vested interest. There may already be a usable simulation in existence that requires very little tailoring. It is certainly worth considering.

Much like an athletic team, a coalition consists of leaders and followers. A coalition is managed by the equivalent of a coach. There will most certainly be spectators. Unfortunately, as in sports, there will be an opponent of some sort. The current vision anticipates a "near peer" adversary somewhere down the line. It also anticipates "something less," perhaps a catastrophic flood, a devastating famine, a destabilizing and brutal civil war. Regardless of what it looks like or what it is called, it will still be a threat.

Often there will be choices about what each coalition member provides, both strategically and/or operationally. These choices may very well provide the super adhesive that holds the seams forever. Unwisely selected, they could also be the cause for a coalition failure. Our CINCs must look outside "the box" and make the right decisions when defining the roles of each coalition member and selecting the resources they may provide. We cannot force a coalition member to play an unwanted role. They must be a willing contributor for the coalition to survive.

All this may sound pretty overwhelming and laborious. But with a policy of engagement and enlargement, it is our future.¹⁰ Actually these principles have always been applied when we deploy or mobilize U.S. forces. The difference is that we must now think globally, long before we "hit the playing field." Usually logistics force structure tends to build up ad hoc: we come as we are, figure out what more we need, then go get it when we can. We can no longer do business this way.

A concept perhaps born out of recent deployments is a logistics task force (LTF). We should now institutionalize an LTF, incorporating it in our doctrine. Commanders throughout the Army seem to recognize the LTF as a necessity, but only as an ad hoc organization. We should consider the following three LTF realities: 1) Logistics headquarters are lean, 2) planning for an LTF is imperative, and 3) our current doctrinal literature and tables of organization and equipment (TO&E) are woefully inadequate.¹¹

The LTF consists of three elements: the advance echelon, the main body, and a stay-behind rear detachment. Forming an LTF does not come without difficulties. Like an athletic team, the LTF is constrained by the total allowed numbers of resources to include people and equipment. People may be further categorized by skills. For those low density skills or specialties, a shortage of resources to do one or more of the missions is a problem when the same skill needs to be applied in one or more locations. This situation demands outside resourcing that generates still more challenges for the losing commander who gives up his precious resources to meet the demands of the LTF. Further, how can normal mission functions be continued with reduced assets and how does the commander measure and maintain readiness of those deployed elements?¹² Unfortunately, when units are deployed, critical perishable skills may go untrained. Skill erosion begins.

There are two steps for forming an LTF. The first is simply the command group's decision to form an LTF. The second is to create a TO&E tailored to the mission. Then, each element of the LTF will begin to train on their specific LTF missions. They will reap many benefits through cross training, learning strengths and weaknesses and creating a unit cohesiveness. The deployable command, control, communications, computers, intelligence, and information (C4I2) package will begin to meld.¹³

To integrate the LTF into the Army's force structure, we should carry out the following recommendations:

- 1) Invest in an appropriate C4I2 system.
- 2) Change the TO&E accordingly.
- 3) Update deployment and sustainment doctrine.
- 4) Commence institutionalized LTF training.
- 5) Revise LTF readiness reporting to include status of LTF.¹⁴

Institutionalization of LTFs will thus justify the kind of training and simulation we need to support current and future coalition operations. One might ask about the feasibility of outsourcing the LTF. It certainly seems worth consideration, but an opinion at this point would be premature without further research.

While the LTF facilitates support at the tactical and operational levels, the Army Materiel Command has developed and successfully implemented the Logistic Support Element (LSE) concept, which addresses the wholesale or strategic level of support. This in-theater depot level support has proven successful in Bosnia. It was equally responsive when deployed to Florida following Hurricane Andrew in 1992. Responsive, rapidly

deployable, flexible, and tailorable LSEs are capable of satisfying mission requirements whenever and wherever needed.¹⁵

But this is really only the beginning. Once we have the data and documented justification for such needs as troops, access agreements, funding for military-to-military contacts, operating funds, security assistance, funding for combined and joint exercises, and related activities, we can approach our civilian leadership with credibility. Coalition planning may be the first critical step in fulfilling our National Military Strategy. We must get it right the first time. Otherwise we risk catastrophic failure not simply of a mission, but of a viable concept for world order.

REVOLUTION IN MILITARY LOGISTICS

Already on a glidepath to transition from a massive stockpiling or a “just in case” system to a “just in time” system, the U.S. Army leadership knows that asset visibility is imperative. We have moved from a supply-based to a distribution-based support system. This transition represents nothing more than an evolution of concepts. It has been budget-driven from many perspectives. We no longer have the massive forward presence and the concomitant logistics stockpiles that we sustained during the cold war. Further, with the end of the Cold War came extreme budget cuts to the defense dollars.

Force XXI is the Army’s use and testing of information technology. While not to be taken lightly, the question arises as to whether this is truly a revolution in military affairs as senior Army leaders portend.

Webster says a revolution is “a sudden, complete, or radical change.” Certainly the battlefield commanders have more information available to them than ever before, but the information was always there. We just gather, transmit, and disseminate the data faster

than before. To automate a process only speeds up the process. If it were a bad process to begin with, you have succeeded in doing something bad faster! Most, if not all, changes we see today are only evolutionary as revolutions require a drastic change.

Even our National Military Strategy builds on its predecessors and continues the evolution from the strategies developed during the Cold War. The logistics strategy is not much different. There may not have been any true revolutionary changes in logistics since the early 1500s when armies began to carry needed supplies rather than relying on the surrounding countryside. Even this may have been evolutionary.

With the advent of the Defense Budget Operating Fund, end users could no longer afford to maintain those "just in case" stocks. Retail or wholesale level, inventory has declined dramatically. This has forced logisticians to respond promptly to the customers. An automated system now enables us to maintain visibility of stocks even while in transit. This program is called Total Asset Visibility (TAV.) Without TAV, items cannot be easily expedited or diverted after being shipped.¹⁶ Knowing the location of all items in the supply pipeline or maintenance process is the key characteristic of a responsive distribution system.

Velocity Management, touted as a revolutionary application of modern technology has emerged as the latest logistical initiative. Velocity Management gives logisticians the ability to track intransit supplies. Although it certainly can facilitate management decisions to expedite shipments, it in no way makes the transporter move any faster. This is not sufficient.

TAV has been complemented by faster transportation, which has developed because:

- 1) elimination of the "just in case" stocks and 2) the U.S. Army Vision 2010 of dominant

maneuver and precision strike. The continuous high Operating Tempo (OPTEMPO) of widely dispersed combat teams will increase demands for consumables and transportation. Knowing where the supplies are at any moment is only one piece of the solution. Moving the supplies faster is a second vital piece.¹⁷

The Army has taken steps to improve the transportation or distribution process. First, deployed troops arrive with some stocks on hand. Also, we preposition stocks on land and sea in those theaters to which we are likely to deploy. Likewise, procurement of the C-17 strategic lift aircraft and Large Medium Speed Roll-on Roll-off ships have enhanced timely logistical support. But these are long-term solutions. Until we realize the full operational capability of these procurements, we must take precautionary steps to compensate in the near term.

. A number of technological advances are improving delivery performance. The consolidation and containerization point (CCP) in New Cumberland, PA, monitors and tracks supplies destined for Bosnia. Items shipped through the air lines of communication to Bosnia are consolidated at this CCP. Supplies arrive at the CCP from depots throughout the U.S. and are consolidated into packages for requisitioning units, which reduces in-country transfer burdens.¹⁸

Modern technology facilitates tracking of these supplies. The computer linkages allow “trackers” to determine when items have left depots or contractors. Once items arrive at the airports of embarkation, the global transportation network (GTN) begins to track the materiel. Status of cargo goes into the logistics intelligence file (LIF), by means of which a “tracker” can remotely monitor shipment status.¹⁹

Intransit visibility has always been a challenge. Two types of technology are improving this process. First optical laser cards accompany the shipment. A hand-held scanner electronically reads the cards which list the pallet's contents. Additionally, shipments contain radio frequency (RF) transmitters. So a reader located at the entry gates to some installations reads the RF transmitter as it passes.²⁰

The more sophisticated international transportation information tracking (INTRASIT) system is a useful satellite-based tracking system. INTRASIT provides the current status of all materiel plugged into the system.

Finally, the daily exchange of cargo status has been very helpful. The 21st Theater Army Area Command gets daily reports from New Cumberland. These reports report true status of each pallet and of its contents. Current technology has greatly enhanced the quality of logistics support.²¹

Split-based operations have also evolved as a result of limited strategic airlift and sometimes limited in-theater aerial and seaports. Seeking to reduce the in-theater logistics footprint, we tailor our force packages so that only a few logisticians are required in the theater of operations. However, we are learning now in Bosnia that we may need more on-site logisticians, especially in support of a multinational force.

The magnitude of the operation is important. Thirty-five nations have used ports of debarkation in Bosnia-Herzegovina. Over half of these countries are non-NATO members. They have moved in over 2,800 aircraft, 400 trains, and 50 ships, which have transported over 205,000 tons of cargo and 40,000 personnel. These movements have required coordination among contributing countries, NATO countries, and countries along the deployment routes.²²

As in any other troop deployment effort, the operational concept has driven development of troop requirements. Each participant submitted its own list of potential force participants. Supreme Allied Commander Europe (SACEUR) then selected the troops to make up the Implementation Force (IFOR).²³ The troop list having been developed, SACEUR planners began to prioritize the order of arrivals. This included a timeline by country and by movement routes. All this had begun prior to the signing of the Dayton Peace Agreement. Some units were already in the queue and were enroute before the Agreement had been signed.²⁴

Since more than half of the participating countries were non-NATO, movement management tools varied. While NATO countries used the allied deployment and movement system (ADAMS), the non-NATO countries interfaced manually. Despite this disparity, the troops arrived in a fairly orderly fashion.²⁵

This multinational deployment posed four challenges: 1) standardized reports, 2) deployment plan formats, 3) transit clearances, and 4) personnel augmentation. The participants' willingness to work things out overcame all four challenges. And many valuable lessons were learned.²⁶

This multinational deployment has been supported by a split-based logistical concept, provided by the 29th Support Group. Some of the unit moved to and operated in-theater, but a larger portion remained at home station in Germany.²⁷ As it turned out, the 29th was already well organized with military and civilian personnel. It quickly formed a forward logistics support element.²⁸

The next step was deploying the support element to an intermediate staging area in Hungary. Since reflagging in 1980, the 29th not deployed a single time. Those desig-

nated for deployment began to prepare. Others focused on supporting their deployment by ensuring all equipment was ready.²⁹

Once the forward element was in country, the reception, staging, onward movement, and integration (RSOI) mission took top priority. Visibility of inbound stocks and storage presented the first challenges. Daily communications with the rear element in Germany proved invaluable in working this issue. Priorities of shipments were shuffled accordingly. Overall, the deployment was successful.³⁰

Doctrinally, the group would normally deploy to a mature theater with transportation functions in place. This was not true for Bosnia. Thus, the 37th TRANSCOM augmented the 29th Support Group staff with personnel to manage the transportation. Assisted by the 191st Ordnance Battalion, the group was able to successfully move forward over 1,700 unit equipment containers by March of 1996.³¹

Once the RSOI mission was flowing smoothly, the 29th addressed the sustainment of forces mission. With technical expertise from the rear, the 29th expanded their direct support efforts to general support. Demand data was based on operational tempo, then stocks were adjusted accordingly.³²

The 29th's effective support demonstrated success of our distribution-based, Focused Logistics system, which capitalizes on the synergy of information supremacy and distribution agility to replace logistics mass with logistics velocity. Simply stated, we have traded mass for velocity through an evolutionary process. All this has been accomplished through the application and leveraging of modern technology and innovative force projection.³³ Is this a revolutionary development in military affairs? If not, what does constitute a revolution?

NEW AND EMERGING TECHNOLOGIES

For thousands of years, man has used the sun's energy for a variety of things. Probably the very first use was using some sunlight for passive heating or drying of materiel. Eventually the sun's energy came to be used to dry food stuff as a means of preservation. Crude bricks were then sun-dried for building materials. The hides of animals were placed in the sun to dry for clothing. But not until recent decades has there been a serious investigation into the use of solar energy as a viable alternative to more conventional non-renewable energy resources such as coal, oil, and nuclear fuels.

With a constant parametric increase in the world's population, the consumption of nonrenewable energy resources has been a valid global concern for several decades. The World Energy Council, established to collectively consider energy alternatives, consists of an international membership of one hundred countries. With interests broader than solar energy alone, it has studied several renewable energy resources, such as wind, geothermal, biomass, ocean, and hydropower energies. The National Aeronautical and Space Administration joined with the National Science Foundation in 1972 to look at solar energy as a national energy resource. In addition, a number of private and/or commercial concerns are seeking alternate sources of power.³⁴

The notion of using solar energy is driven primarily by the age old concept of supply and demand. Studies conducted in 1970 forecast that over 25% of the world's energy consumption would come from nuclear power by the year 2000.³⁵ Statistics in 1986 indicated less than 5% of energy consumption was provided by nuclear power. This is not nearly the nuclear power consumption rate that was projected in 1970.³⁶ The shortfall resulted from international concern for the ecological effects of energy resource con-

sumption. The nuclear hazards posed by the Three Mile Island nuclear power plant shutdown and the more horrific Chernobyl meltdown did little to encourage the increased use of nuclear energy. The more recently identified phenomenon known as acid rain has also increased our awareness of problems created by sources of energy.

Consider that our sun sends 25,000 trillion horsepower of energy each year. By 1963 statistics, this was 1,700 times as much as we need.³⁷ The beauty of solar energy is three-fold. It is everywhere, requires no maintenance or transportation, and it is free!³⁸ But we have not developed technology to make large-scale practical use of solar energy. The radiation striking the earth's surface provides only 150-200 Btu per hr per sq. ft.(One British thermal unit to raise the temperature of one pound of water one degree Fahrenheit.) An average home in Colorado requires 50-100 million Btus for heating in a single year.³⁹ So collecting the sun's energy poses a logistical challenge due to the enormous size required for solar collectors to absorb significant amounts of solar energy.

In 1958, the Vanguard satellite ushered in the use of solar technology for the space age. Scientists harnessed the sun's energy using an on board solar battery to power a tiny radio transmitter. In five years it used the equivalent to 55 pounds of conventional dry cell batteries that would have been exhausted in mere hours. The satellite itself weighed only 60 ounces!⁴⁰ Weight savings and life span were significant advantages in this application, which has continued through our current space programs. The very satellites that provided precise locations to our soldiers in Desert Shield/Storm were powered by solar cells.

Reliance on petroleum as an energy resource has increased over time at a steady rate. About 28% of U.S. primary energy consumption is of petroleum.⁴¹ We import one third

of that amount. While this may seem like a relatively small portion, it still renders us dependent on outside sources to meet our energy demands. Some believe that the Gulf War was fought over oil. That argument will most likely never be settled. In any case, we have sufficient incentive to pursue alternate renewable energy resources.

Oddly enough, there are some rather significant correlations in the positive and negative traits of solar energy. Technology has focused primarily upon the use of solar energy for heating of air space and water. The energy needed for cooling during summer is an example of one such correlation. While the amount of solar energy received on earth varies by region, it also obviously varies by time of year. The amount of potential energy increases significantly in the summer months, a peak demand period for energy!⁴²

Six major regional areas in the world are very conducive to the collection of solar energy.⁴³ These, not surprisingly, are the desert areas of the world. Additionally, there are many unresolved issues surrounding the efficient and effective use of solar energy. These issues range from technical to economic to sociocultural.

Since the oil price shock of 1973, governments of the developed countries have spent over U.S.\$ 4 billion on research and development for solar energy technologies.⁴⁴ The largest portion of the money has gone to the high technology applications-not to the more conventional applications, where the demand is greatest. Developing regions of the world-such as Sub-Saharan Africa, China, and South America-have the greatest potential for demands on energy. Industry has spent many times more on the much needed conventional applications of solar energy.

One last significant impact bearing on the current and future use of solar energy is that of governmental policies throughout the world.⁴⁵ Although the trend is changing, many

countries do not have incentives in place to encourage the development or use of new renewable energy resources such as solar energy. Until our leaders recognize the importance of these alternative energy resources and establish their development and use as realistic long-term goals, we will continue to consume our limited natural resources with no change in view.

With the right approach, U.S. industry could become a dominant player in the development and use of solar energy. With the technical skill and the capital to invest in the required research and development (R&D), we could create a product in such universal demand that U.S. industry could enjoy a trade balance never before matched. I can only imagine the outcome should the President of the U.S. declare that we will provide over half the world's energy requirements from solar energy by the year 2020! We could turn African economies into thriving and productive metropolises. Our class III demands in the battle space would diminish if not disappear. We would need fewer vehicles, and they would be lighter. Strategic lift demands would change dramatically. This list of significant positive impacts is endless. If developed, this could be our next true national power and a real revolution in not just military logistics, but military affairs total!

Energy is only one technology that could be targeted. There are many others that have varying levels of unknown risk. The "beam me up Scottie" matter transfer technology, if developed, would have an equally profound and dramatic impact on the world as we know it. These things may sound too futuristic, but so did putting a man on the moon!

CONCLUSION

The U.S. Army has clearly taken some evolutionary measures to sustain and improve logistical support to deployed forces. As a member of NATO, we have formed a multinational deployment agency to manage the strategic movement of forces.⁴⁶ We have created successful ad hoc logistics task forces and deployed them in response to several crises. But the “iron mountain” or supply-based support system is now distribution-based. We portend to have Total Asset Visibility and our strategic air- and sea-lifts are being upgraded at this very moment. We can track entire shipments using a modern satellite-based tracking system. Our forward Logistics Support Element and our split-based operations have joined to reduce the in-theater logistical footprint. Velocity Management is alive and well. All of these things have evolved in response to our plans to deploy as a part of a coalition force and due to the shrinking U.S. defense dollar.

America’s leadership must now step forward and commit resources to develop and apply technologies focused on radically changing our logistics support. Solar energy, or some other alternative energy source could serve as the catalyst to launch us into a true revolution in military logistics. Think of how dramatic our vital interests would change if we no longer relied on petroleum as an energy source. More specific to logistics is the potential to reduce or eliminate the enormous burden of supplying an offensive force with millions of gallons of various types of petroleum based fuels. Our environment would be better preserved and a longterm cost savings may result.

Until we target a technology like solar energy that has promising dramatic impact, we will continue to evolve with a reactive logistic support concept and never realize a radical change so desperately needed to take us into the next millennium. Our countries leader-

ship must continue to define and preserve our vital interests, but must invest in redefining those interests through innovative and creative thinking.

ENDNOTES

¹Kenneth Allard, Somalia Operations: Lessons Learned (Washington: National Defense University Press, 1995), 41.

²Robert H. Scales, Certain Victory: The U.S. Army in the Gulf War (Fort Leavenworth, KS: U.S. Army Command and General Staff College Press, 1994), 60.

³ Ibid., 69.

⁴ The White House, "A National Security Strategy of Engagement and Enlargement" (Washington, D.C.: U.S. Government Printing Office, 1996), 43.

⁵Charles A. Seland, "The New NATO." Army Logistian, (May-June 1996); 4.

⁶ Ibid.

⁷ Ibid., 5.

⁸ Ibid., 7.

⁹ Ibid.

¹⁰The White House, "A National Security Strategy of Engagement and Enlargement," 11.

¹¹Larry D. Harman, "A Logistics Task Force Mentality," Army Logistian, (November-December 1996); 4.

¹²Ibid.

¹³Ibid., 5.

¹⁴Ibid.

¹⁵ Department of the Army, Logistics Support Element Tactics, Techniques, and Procedures, Field Manual 63-11 (Washington, D.C.: U.S. Department of the Army, 8 October 1996), 2-1.

¹⁶Department of the Army, Revolution in Military Logistics (Washington, D.C.: U.S. Department of the Army, undated), 8.

¹⁷Ibid., 7.

¹⁸Phillip D. Lucius, "Supply Pipeline to Bosnia," Army Logistician (November-December 1996): 24.

¹⁹Ibid., 27.

²⁰Ibid.

²¹Ibid., 28.

²² Nicholas J. Anderson, "Multinational Deployments in Operation Joint Endeavor," Army Logistician (November-December 1996): 21.

²³Ibid.

²⁴Ibid., 22.

²⁵Ibid., 23.

²⁶Ibid.

²⁷ Steven A. Shapiro, "Task Organization for Bosnia," Army Logistician (November-December 1996): 34-35.

²⁸Ibid.

²⁹Ibid.

³⁰Ibid., 35.

³¹Ibid.

³²Ibid.

³³ Department of the Army, Revolution in Military Logistics, 9.

³⁴ U.S. National Science Foundation and National Aeronautical and Space Administration Solar Energy Panel, An Assessment of Solar Energy as a National Energy Resource (Washington, D.C.: U.S. Government Printing Office, 1972), 2.

³⁵Ibid.

³⁶David J. Cuff and William J. Young, The United States Energy Atlas (New York: Mcmillan Publishing Co., 1986), 2.

³⁷D. S. Halacy, Jr., The Coming Age of Solar Energy (New York, Evanston, and London: Harper & Row, 1963), 1.

³⁸World Energy Council, New Renewable Energy Resources (London: Kogan Page Limited, 1994), 65.

³⁹Halacy, 2.

⁴⁰Ibid., 28.

⁴¹Cuff, 5.

⁴²U.S. Council on Environmental Quality, Solar Energy: Progress and Promise (Washington, D.C.: U.S. Government Printing Office, 1978), 4.

⁴³World Energy Council, New Renewable Energy Resources , 106.

⁴⁴Ibid., 74.

⁴⁵Ibid., 125.

⁴⁶Seland, 5.

BIBLIOGRAPHY

Allard, Kenneth. Somalia Operations: Lessons Learned. Washington: National Defense University Press, 1995.

Anderson, Nicholas J. "Multinational Deployments in Operation Joint Endeavor." Army Logistician, November-December 1996, 20-23.

Cuff, David J., and William J. Young. The United States Energy Atlas. New York: McMillan Publishing Company, 1986.

Evers, Stacey and Joris Jansen, "UN counts assets in disaster relief role," Defense Issues, 26, no. 9, (1996): 21-23.

Halacy, D. S., Jr. The Coming Age of Solar Energy. New York, Evanston, and London: Harper & Row, 1963.

Harman, Larry D. "A Logistics Task Force Mentality." Army Logistician, November-December 1996, 4-5.

Johnsen, William T. and Thomas-Durell Young. "Partnership for Peace: Discerning Fact from Fiction", Strategic Studies Institute.

Libby, Corenthia V. "Operation Quick Lift." Army Logistician, July-August 1996, 40-41.

Lucius, Phillip D. "Supply Pipeline to Bosnia." Army Logistician, November-December 1996, 24-28.

McNeil, John H. "Military-to-Military Arrangements for the Prevention of U.S.-Russian Conflict." Naval War College Review, 47, no. 2, 1994: 1.

Naylor, Sean D. "Revolutionizing Battlefield Logistics." Defense Trends, 11 November 1996, 30.

O'Neill, Kathryn M. "Reorganizing Movement Control." Army Logistician, July-August 1996, 12-13.

Perry, William J. "Change Means Challenge and Opportunity." Defense Issues, 11, no. 47, 26.

Riscassi, Robert W. "Principles for Coalition Warfare." Joint Force Quarterly, no. 1 (1993): 58-71.

Scales, Robert H. Certain Victory: The U.S. Army in the Gulf War. Fort Leavenworth, KS:

U.S. Army Command and General Staff College Press, 1994.

Seland, Charles A. "The New NATO." Army Logistian, May-June 1996, 4-7.

Shapiro, Steven A. "Task Organization for Bosnia." Army Logistian, November-December 1996, 34-35.

Stowe, Charles R. B, "Joint Military Contact Team Poland Building Regional Stability." ROA National Security Report, The Officer, September 1994, 25.

The White House. "A National Security Strategy of Engagement and Enlargement" Washington, D.C.: U.S. Government Printing Office, 1996.

U.S. Council on Environmental Quality. Solar Energy: Progress and Promise Washington: U.S. Government Printing Office, 1978.

U.S. Department of the Army. Army Operational Support. Field Manual 100-16. Washington, D.C.: U.S. Department of the Army, May 1995.

U.S. Department of the Army. Army Pre-Positioned Afloat Operations. Field Manual 100-17-1. Washington, D.C.: U.S. Department of the Army, July 1996.

U.S. Department of the Army. Army Vision 2010. Vision Statement. Washington, D.C.: U.S. Department of the Army, undated.

U.S. Department of the Army. Decisive Force: The Army in Theater Operations. Field Manual 100-7. Washington, D.C.: U.S. Department of the Army, May 1995.

U.S. Department of the Army. Domestic Support Operations. Field Manual 100-19. Washington, D.C.: U.S. Department of the Army, July 1993.

U.S. Department of the Army. Force XXI Operations. TRADOC Pamphlet 525-5. Washington, D.C.: U.S. Department of the Army, August 1994.

U.S. Department of the Army. Meeting the Challenges of Today, Tomorrow, and the 21st Century. Posture Statement FY 97. Washington, D.C.: U.S. Department of the Army, undated.

U.S. Department of the Army. Peace Operations. Field Manual 100-23. Washington, D.C.: U.S. Department of the Army, December 1994.

U.S. Department of the Army. Logistics Support Element Tactics, Techniques, and Procedures. Field Manual 63-11. Washington, D.C.: U.S. Department of the Army,

October 1996.

U.S. Department of the Army. Revolution in Military Logistics. Washington, D.C.: U.S. Department of the Army, undated.

U.S. Department of the Army. The Army Strategic Logistics Plan. Washington, D.C.: U.S. Department of the Army, undated.

U.S. Joint Chiefs of Staff. Doctrine for Logistic Support of Joint Operations. Joint Pub 4-0. Joint Chiefs of Staff, January 1995.

U.S. Joint Chiefs of Staff. Joint Doctrine for Mobilization Planning. Joint Pub 4-05. Joint Chiefs of Staff, June 1995.

U.S. Joint Chiefs of Staff. National Military Strategy. Strategy Statement. Joint Chiefs of Staff, 1995.

U.S. National Science Foundation and National Aeronautical and Space Administration Solar Energy Panel. An Assessment of Solar Energy as a National Energy Resource. Washington: U.S. Government Printing Office, 1972.

Van Creveld, Martin. Technology and War. New York: The Free Press, 1991.

World Energy Council. New Renewable Energy Resources. London: Kogan Page Limited, 1994.

Widnall, Sheila E. "Military-to-Military Contacts: Breaking Stereotypes." Defense Issues, 9, no. 88: 1.